"A STUDY TO ANALYSE THE EFFECTIVENESS OF MODIFIED PROPRIOCEPTIVE NEUROMUSCULAR REPEATED FACILITATION FOR THE UPPER EXTREMITY MOTOR PERFORMANCE IN SUB ACUTE STROKE PATIENTS"

A DISSERTATION SUBMITTED TO THE TAMILNADU Dr. M.G.R MEDICAL UNIVERSITY, CHENNAI, AS PARTIAL FULFILLMENT OF THE MASTER OF PHYSIOTHERAPY DEGREE

APRIL 2012.

A dissertation on

"A STUDY TO ANALYSE THE EFFECTIVENESS OF MODIFIED PROPRIOCEPTIVE NEUROMUSCULAR REPEATED FACILITATION FOR THE UPPER EXTREMITY MOTOR PERFORMANCE IN SUB ACUTE STROKE PATIENTS"

Has been Submitted in partial fulfillment for the requirement of the

Master of Physiotherapy Degree

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Internal Examiner **External Examiner**

CERTIFICATE

Certified that this is the bonafide work of **Miss. P.REVATHY** of K.G. College of Physiotherapy, Coimbatore submitted in partial fulfillment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr..M.G.R. Medical University under the **Registration No: 27102211** for the April 2012 Examination.

Place : Coimbatore Principal

Date :

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Under the guidance of,

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CONTENTS

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I. INTRODUCTION

Stroke is defined as “a rapidly developing clinical sign of a focal or global disturbance of cerebral function lasting for more than 24 hours or leading to death due to no other reason than the vascular origin” [WHO, 1997].

Stroke is the third leading killer in the world and in India after heart disease and cancer .Among all the neurological disease of adult life Cerebrovascular accidents clearly ranks first in frequency and in importance.

Cerebral infarctions accounts for 80%, Primary intra Cerebral hemorrhage for 10% and Subarachnoid Haemorrhage for 5 % of all the first strokes [Warlow 1993].

The most common insult to the brain results in Middle Cerebral artery lesions. More than two thirds of all first strokes are within the distributions of Middle Cerebral Artery.

The Middle Cerebral Artery is the most common site of occlusion and it supplies the entire lateral aspect of cerebral hemisphere. Frontal, Temporal, Parietal and Sub-cortical structures

including Internal Capsule [posterior portion], Corona Radiata, Globus pallidus [outer part], most of the Caudate nucleus and Putamen.

The most common characteristics of MCA syndromes are contra- lateral spastic hemiparesis, sensory loss of face, upper extremity and lower extremity and with more involvement of face. Homonymous hemianopia is also a common symptom in this type of stroke.

The treatment of patients with strokes have traditionally included facilitation techniques such as Brunnstrom, rood etc. Standard neuro physiological facilitation techniques used for hemiplegic upper limbs have not provided conclusive evidence to promote the functional recovery of hemiplegic limbs. These neuro physiological approaches mainly aim to normalize muscle tone or asymmetric posture and not to strengthen neuronal circuits through the injured descending motor tracts by the repetitions of the patient's intended movements.

Proprioceptive Neuromuscular Facilitation (PNF) (Knott and Voss, 1968) facilitates mass movement patterns against resistance in a

spiral or diagonal motion during flexion and extension (Cuccurullo et al. 2004). *Proprioceptive* is the information concerning movement and position of the body that is given by sensory receptors. *Neuromuscular* is everything involving the nerves and muscles. *Facilitation* is the term used when making it easier for the patient (Adler et al. 2003). In order to treat the patient according to the principles of PNF, each treatment has to be an overall positive approach (Adler et al. 2003). The primary goal of PNF is to help achieve the patient's highest level of function by making use of proprioceptive sensory stimuli and brain stem reflexes to facilitate the desired movement and inhibit unwanted movements (Adler et al. 2003). Repetitive facilitation technique, a novel modification of the conventional Proprioceptive Neuromuscular Facilitation Technique works by making the patient realize his intended movements by activating neurons related to the intended movements by stretch reflex or skin muscle reflex elicited at the time of the intended movement and also facilitation of the pre frontal or pre motor cortex resulting in neuronal excitation in patients intention

The purpose of the study was to analyze the effectiveness of a modified neuromuscular repeated facilitation exercise in the

improvement of upper extremity motor function of patients with sub acute stoke.

1.1. NEED FOR THE STUDY:

Stroke is a most common debilitating disorder which affects middle and elderly individuals. The occurrence of stroke is becoming extremely common place even in younger age individuals. The relative severity of the disorder with its propensity for severe disability has made it a priority among all neurological disorders. The rehabilitation of the stroke is extremely complex and governed by a variety of factors. The lack of a scientific and unified approach for rehabilitation of stroke has resulted in severe residual deficits. At present there is a lack of consensus among rehabilitation professionals regarding effective treatment for such a condition, with intuition based treatment being favored over the scientific approach. Proprioceptive neuromuscular facilitation has been used quite for some time, but it is time consuming and difficult to administer with conflicting results, modification of such an approach with a novel facilitation techniques have been suggested to improve the outcome after stroke, but at present very little literature is

available to comprehensively prove the outcome. Therefore, the need for the study.

1.2. STATEMENT OF THE PROBEM:

A study to analyze the effectiveness of Modified Proprioceptive Neuromuscular Repeated Facilitation for the Upper Extremity Motor Performance in Sub -acute Stroke Patients

1.3. KEY WORDS:

- Stroke
- Modified Neuromuscular Facilitation
- Upper Limb Motor Performance
- Wolf Motor Function Test
- Action Research Arm Test

1.4. OBJECTIVES OF THE STUDY:-

- To assess the upper extremity motor performance of patients with sub acute hemi paretic stroke

- Use of Modified Proprioceptive Neuromuscular Repeated Facilitation in addition to conventional therapy to patients with sub acute stroke and analyzing the outcome.

- Use of Rood's Facilitation in additional to conventional therapy and analyzing the outcome.

- Use of Conventional therapy in patients with sub acute stroke and analyzing the outcome.

- Analyze the effectiveness of Modified Proprioceptive Neuromuscular Repeated Facilitation in the improvement of Upper Extremity Motor Performance in patients with sub acute stroke.

1.5. HYPOTHESIS:

1.5.1 NULL HYPOTHESIS:-

There is no significant difference in the upper extremity motor performance of patients with sub acute stroke using Modified Proprioceptive Neuromuscular Repeated Facilitation when compared with Rood's facilitation and conventional therapy.

1.5.2 ALTERNATE HYPOTHESIS:-

There is a significant difference in the upper extremity motor performance of patients with sub acute stroke using Modified Proprioceptive Neuromuscular Repeated Facilitation when compared with Rood's facilitation and conventional therapy.

II. REVIEWS OF LITERATURE

STROKE

Venkatasubramanian et al., (2005)

Studied the stroke prevalence data among mixed Asian populations of age's ≥ 50 years which included Chinese Malay and Indian origin people. The participants were selected using a disproportionate stratified random sampling. 6734 men ,8172 women of the age 52 -106 years with Chinese Malay and Indian ratio 3:1:1 were choosen and analysis of the results after a detailed evaluation showed that there is no significant difference in the prevalence rate between the Chinese, Malay, Indian and Singaporeans. Although the prevalence seems to be higher among Chinese women and lowest among Malay women

Das et al., (2007)

Conducted a prospective community based study in Calcutta by screening a population of 52,377 people (27,626 – men and 24,751 - women) and concluded that an age standard is prevalence and incidence of stroke. In this stroke are similar to or higher than many western nations. Over all categories fatal rate was highest in the world.

Das and Banerjee et al., (2008)

Conducted a study on the prevalence of stroke in India and found that that the prevalence of stroke has been very much on the rise due to a concomitant change in people's life style leading to work related stress and altered food habits raising the risk of hypertension these factors when coupled with increase life expectancy could lead to the increased incidence of stroke. It has been proved by high prevalence of cerebral hemorrhage documented in eastern India.

Mishra et al., (2010)

Studied the incidence of stroke in India and concluded that there is a stroke epidemic which necessitates the development of a National programme towards fighting stroke which should be cater to our national needs and emphasized the development of a national network on training and research in stroke so as to develop a comprehensive "India fights stroke programme".

Anderson et al., (2009)

Compared stroke patients with hemorrhage and ischemic stroke in regards to severity, mortality and cardiogenic causes and concluded that ischemic stroke is ten times more frequent than hemorrhagic stroke in western countries but severity is more than in hemorrhagic stroke.

Satoh et al., (1991)

Surveyed the incidence of ischemic cardio vascular accident in children of a district in Japan by evaluating 54 cases of cerebral infarction excluding Moya moya's disease in patients <16 years and concluded that middle cerebral artery region including basal ganglia was the most commonly affected and recovery after stroke seems to be better than that of adults.

PROPRIOCEPTIVE NEURO MUSCULAR FACILITATION

Dickstein et al., (1986)

Conducted a study to compare the effectiveness of 3 exercise therapy approaches on recovery in adult stroke patients. 3 groups of patients were selected. First group received conventional therapy; Second group received Proprioceptive Neuromuscular Facilitation; Third group received treatment with Bobath approach. Outcome was analyzed after 6 weeks using Barthel Index changes in muscle tone using 5 point ordinal scale and changes in isolated motor control of ankle and wrist as measured by range of motion, muscle strength and ambulatory status using a nominal scale of 4 categories and found significant benefits in all 3 groups with no specific improvements attributed to either of the treatment approaches.

Butefisch et al., (1995)

Investigated the effects of repetitive training to rehabilitate the paretic hand patients received normal treatment using Bobath approach and used a multiple baseline approach to analyze the effect of specific training on 3 motor functions of the hand. Grip strength, isometric and isotonic hand extension. 27 Hemiparetic individuals placed into 2 groups received enhanced non specific therapy and enhanced specific therapy analysis results showed standardized motor training for successful in improving specific movement parameters as of the hand as well as functional motor deficits.

Shimura and Kasai., (2002)

Studied the effects of Proprioceptive neuromuscular facilitation on the initiation of voluntary movement and motor evoked potential in the upper limb and concluded that facilitated position compared to the neutral position. The facilitated position changes the muscle discharge order and lead to the reduction EMG treatment. In addition the motor evoked potential amplitude improved and motor evoked potential latency decreased as a function of proximity of the muscle to the joint.

Woldag and Hummelshim., (2003)

Conducted a study to evaluate evidence based physiotherapeutic concepts for improving arm and hand function in stroke patients and

concluded that repeated motor practice and motor activity is favorable for motor recovery in stroke patients.

Woldag et al., (2003)

Conducted a study to determine whether the repetitive training of complex movements of arm and hand contribute to functional recovery in stroke patients. Using 21 patients involving stroke with MCA territory. The outcome was analyzed using the motor assessment, grip strength rapid isotonic hand extension and 3 – Dimensional Motor Analysis it was concluded that repetitive training of complex movements does not further enhance the functional recovery of affected arm and hand in stroke patients when compared with functionally based occupational therapy.

Page et al., (2004)

Conducted a study for reconsidering the motor recovery plateau in stroke patients and the results of the study suggests that patients with chronic Cerebro Vascular Accident can benefit from New Motor Relearning Program that applied novel or different parameters and modalities.

Luke et al., (2004)

Conducted a study to evaluate the effectiveness of Bobath approach by comparing it with Proprioceptive Neuromuscular Facilitation and concluded that Proprioceptive Neuromuscular Facilitation and Bobath

approach both appear to facilitate motor recovery but could not demonstrate essential superiority of one over the other.

French et al., (2010)

Conducted a study through a systemic review and meta analysis to determine whether repetitive task training improves functional activity after stroke and concluded that repetitive task training results in modest improvement and cause change in the lower limb outcome measures and training may be sufficient to have small amounts of daily living.

ROOD'S APPROACH

Ganz et al., (1988)

Conducted a single subject A-B-A experimental design to investigate the efficacy of neuro motor and sensory facilitation techniques in the oral motor rehabilitation of an individual with a profound developmental disability and concluded that there were improvements in oral motor functioning after this technique align generalizations about the efficacy of these techniques.

Metcalfe et al., (1998)

Conducted survey of Rood's approach and concluded that several of the basic concepts are valid and viable with current neuro scientific thinking

that this approach is a modular model capable of adapting to advancing knowledge.

Nair and Taly., (2002)

Conducted a study of traditional and modern approaches and their usefulness in stroke rehabilitation and concluded that good rehabilitation program using Rood's approach is helpful in promoting natural recovery preventing complications and adapting disabilities.

ACTION RESEARCH ARM FUNCTION TEST

Hsieh et al., (1998)

Studied the intra and inter rater reliability on stroke patients with Action Research Arm Test for assessing recovery of upper extremity function after cortical injury and concluded that the score of Action Research Arm Test cor-related with that of the upper extremity part of motor assessment scale, the arm sub score of the Motor Dexterity Index and Upper Extremity Movements of the Modified Motor Assessment Chart which validates the use of Action Research Arm Test for measuring recovery of arm hand function in stroke patients.

Lee et al., (2001)

Conducted a study to evaluate the responsiveness of Action Research Arm Test on the upper extremity motor section of Fugl Meyer Assessment by comparing them with a cohort of 22 stroke patients were undergoing intensive forced use treatment aimed at improving upper extremity function and concluded that action research arm test is more responsive to improvements in upper extremity function than Fugl Meyer Assessment Scale in chronic stroke patients undergoing forced treatment.

Croarkin et al., (2005)

Studied the reliability and validity of various tests with upper extremity motor function of people with stroke by selecting nine tests which meet the inclusion criteria of the psychometric properties in the literature and concluded that more complete psychometric support is needed for upper extremity motor function tests applied following stroke.

Yozbatiran et al., (2008)

Conducted a study for characterizing the clinical stage and measuring spontaneous and therapy induced recovery using Action Research Arm Function Test and concluded that inter rater and intra rater reliability as well as validity using a standardized approach was excellent and the Action

Research Arm Function Test was performed in a standardized manner and it is a useful tool for the assessment of arm motor deficits after stroke.

WOLF MOTOR FUNCTION TEST

Morris et al., (2001)

Conducted a study to access the reliability of the Wolf Motor Function Test for assessing upper extremity function after stroke. 24 subjects with chronic hemiplegia showing moderate impairment were administered the Wolf Motor Function Test twice with the 2 week interval between administrations intra rater reliability was examined using intra class cor relation co efficient and internal consistency with Cronbach's alpha and results showed that wolf motor function test is an instrument with high intra rater reliability and internal consistency test and retest reliability.

Wolf et al., (2001)

Conducted a study to evaluate its usefulness of Wolf Motor Function Test as a tool for measuring upper extremity performance by studying several psychometric attributes of the scale. 19 individuals after stroke with intact cognition and sitting balance were matched with 19 individuals without impairments. Subjects performed wolf motor function test and upper extremity portion of Fugl Meyer function test on 2 occasions with scoring performed independently by 2 random raters. The results showed significant

agreement with the Wolf Motor Function Tests. Thereby proving the inter rater reliability and intra rater reliability construct validity and criterion validity of the wolf motor function test in chronic stroke patients.

Whitall et al., (2006)

Conducted a study to analyze the psychometric properties of a Modified Wolf Motor Function Test for people with mild and moderate upper extremity hemiparesis. 60 subjects with chronic upper extremity hemiparesis are classified into mild and moderate groups for a large intervention study. Mean and median times of task completion functional ability and strength measures of Wolf Motor Function Test is a reliable and valid outcome measure for people with mild, moderate and chronic hemiparesis.

Adelina et al., (2008)

Conducted a study to investigate the use of Action Research Arm Test, Wolf Motor Function Test and Motor Activity Log in patients with stroke for 12 patients with stroke residing in a community centre Hong-Kong and concluded that Wolf Motor Function Test should be administered first followed by Action Research Arm Function Test to identify problems in certain areas of grasping, pinching and in order to guide treatment.

Chung Lin et al., (2009)

Conducted a study to establish minimally detectable changes and clinically important differences of the patients with stroke using 57 patients who received 1 of 3 treatments for 3 weeks and underwent clinical assessments by comparing the Wolf Motor Function Tests for performance time and Wolf Motor Function Test for functional ability and concluded that Wolf Motor Function Test score is more responsible than the time based of results exceeding the threshold criteria.

III. METHODOLOGY

3.1. STUDY DESIGN

Experimental pre-test and post test study design with two groups.

3.2. STUDY SETTING

Study was conducted at Department of Neurology, Department of Physiotherapy, K.G Hospital, Coimbatore-35.

3.3. STUDY DURATION

The study was conducted for a period of 8 months.

3.4. STUDY SAMPLING

45 Patients were selected and divided into 3 groups of 15 each using the simple random sampling methods.

3.5. CRITERIA FOR SELECTION

3.5.1. INCLUSION CRITERIA

- Ischemic stroke involving middle cerebral artery stroke.
- Age group: - 40-60 years.
- Site: - involving both the sides.
- Duration: - sub acute (6-8 weeks after stroke)
- Brunnstorm's stage of recovery for upper limb and hand: - 3-5.

3.5.2. EXCLUSION CRITERIA

- Severe Sensory Disturbances.
- Severe Shoulder Pain.
- Contractures and deformities
- Aphasia.
- Dementia
- Visuo spatial neglect
- Delusions And psychosis
- Uncontrolled diabetes
- Uncontrolled hypertension
- Severe cardiac abnormalities
- Chronic respiratory problems
- Cognitive Impairments and Perceptual Disorders.

- Associated Peripheral Neuropathies
- Uncooperative Patients.

3.6. OPERATIONAL TOOLS

- Action Research Arm Test
- Wolf Motor Function test

3.7. PARAMETER

- Upper Extremity Motor Function

3.8. ORIENTATION OF SUBJECTS

Before treatment, all the subjects were explained about the study and procedure to be applied, and were asked to inform if they feel any discomfort during the course of the treatment. All the patients who were interested to participate in the study were asked to sign the consent form before the treatment.

3.9. PROCEDURE

A total of 45 patients were selected from a group of 60 and divided randomly into 3 groups of 15 each.

- Group A: patients were treated with modified neuro muscular repeated facilitation technique combined with conventional therapy.

- Group B: patients were treated with Rood's facilitation approach combined with conventional therapy.
- Group C: patients were treated with conventional therapy alone.

Treatment consisted of 2 sessions for about 30-60 minutes of all groups.

- For Group A: Treatment consisted of 30 minutes of modified proprioceptive neuro muscular repeated facilitation exercises combined with 30 minutes of conventional therapy.
- For Group B: Treatment consisted of Rood's facilitation for 10 -15 minutes combined with 45 minutes of conventional therapy.
- For Group C: It consists of 60 minutes of conventional therapy.

The outcome was measured using Action Research Arm Test and Wolf Motor Function Test. The results were tabulate and outcome was analyzed using ANOVA and Post- Hoc test.

3.10. STATISTICAL TOOLS:

In this study, one way ANOVA and student 't' test were used to analyze the data.

Analysis of variance (ANOVA):

Analysis of variance is a statistical technique specially designed to test whether the means of more than two quantitative populations are equal .The ANOVA is used to test for differences among the means of the populations by examining the amount of variations within each of these samples, relative to the amount of variation between the samples.

Formula:

$$F = \frac{S_1^2}{S_2^2}$$

Where, S_1^2 is $S_1^2 = \frac{\Sigma(X_1 - \bar{X}_1)^2}{n_1 - 1}$

S_2^2 is $S_2^2 = \frac{\Sigma(X_2 - \bar{X}_2)^2}{n_2 - 1}$

Formula: Paired t-test

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$t = \frac{\overline{d}\sqrt{n}}{s}$$

Where,

d = difference between the pre-test Vs post-test

$\overline{d}$ = mean difference

n = total number of subjects 1-

s = standard deviation

Formula: Unpaired t-test

$$S = \sqrt{\frac{\sum\left(X_1 - \overline{X_2}\right)^2 + \sum\left(X_2 - \overline{X_2}\right)^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\overline{X_1} - \overline{X_2}}{S}\sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

$\overline{x_1}$ = mean of Group A

$\overline{x_2}$ = mean of Group B

$\sum$ = sum of the value

n_1 = number of subjects in Group A

n_1 = number of subjects in Group B

S = standard deviation

Level of significance: 5%

IV. DATA ANALYSIS AND INTERPRETATIONS

Table – I

One way anova to compare the Pre test values of Group A, B and C – Wolf Motor Function Test

Source of variations	Sum of squares	Degrees of freedom	Mean square	'F' value
Between the groups	0.57	2	0.28	0.04 (F critical value - 3.21)
Within the groups	264.4	42	6.29	
Total	264.97	44		

The observed 'F' ratio of 0.04 is lesser than the 'F' critical value of 3.21 which indicates that there is no significant difference between the three groups before treatment.

Table – II

One way anova to compare the post test values of Group A, B and C – Wolf Motor Function Test

Source of variation	Sum of squares	Degrees of freedom	Mean square	'F' value
Between Groups	1445.2	2	722.6	58.81
Within Groups	\ 516	42	12.28	(F critical value 3.21)
Total	1961.2	44		

The observed 'F' ratio of 58.81 is greater than the 'F' critical value of 3.21 which indicates that there is a significant difference between the three groups before treatment

TABLE - III

Paired 't' test

To compare the Pre test and Post test values of Group A – Wolf Motor Function Test

Within Group A	Mean	Mean difference	SD	't' value
Pre test	42.87	20.66	1.55	28.38
Post test	63.53			

The comparison of pre test and post test values of Group A showed that the't' value is 28.38 which is significantly greater than the 't' value 2.14

This shows that there is a significant improvement in Group A after treatment.

GRAPH-I

Paired ‘t’ test

To compare the Pre test and Post test values of Group A – Wolf Motor Function Test

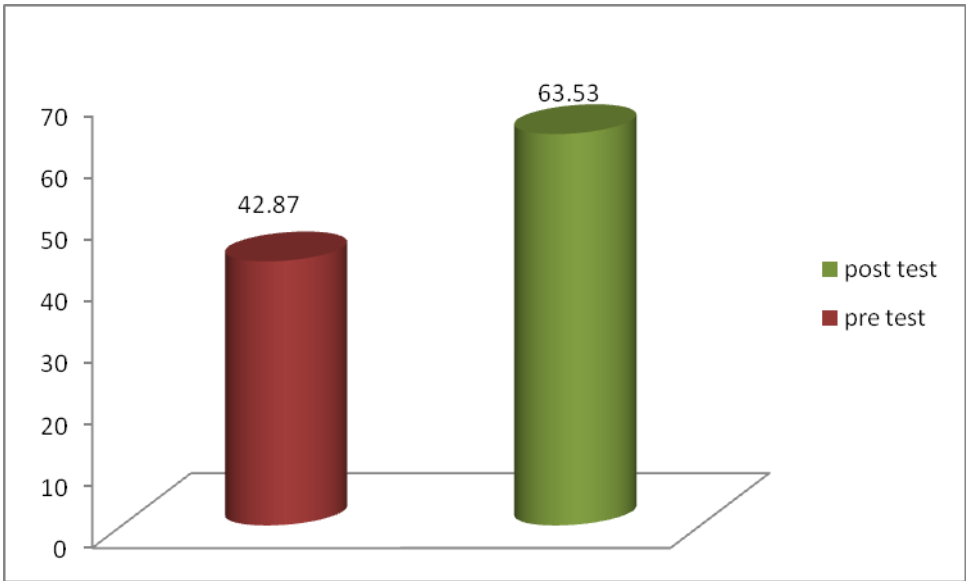


TABLE –IV

Paired ‘t’ test

To compare the Pre test and Post test values of Group B – Wolf Motor Function Test

Within group ‘B”	Mean	Mean Difference	S.D	‘t’ value
Pre test	43.13	12.2	0.96	27.15
Post test	55.33			

The comparison of Pre test and Post test values of group B showed that t value is 27.15 which is significantly greater than the critical t value 2.14 which implies that there is significant improvement in the group B after treatment.

GRAPH-II

Paired ‘t’ test

To compare the Pre test and Post test values of Group B – Wolf Motor Function Test

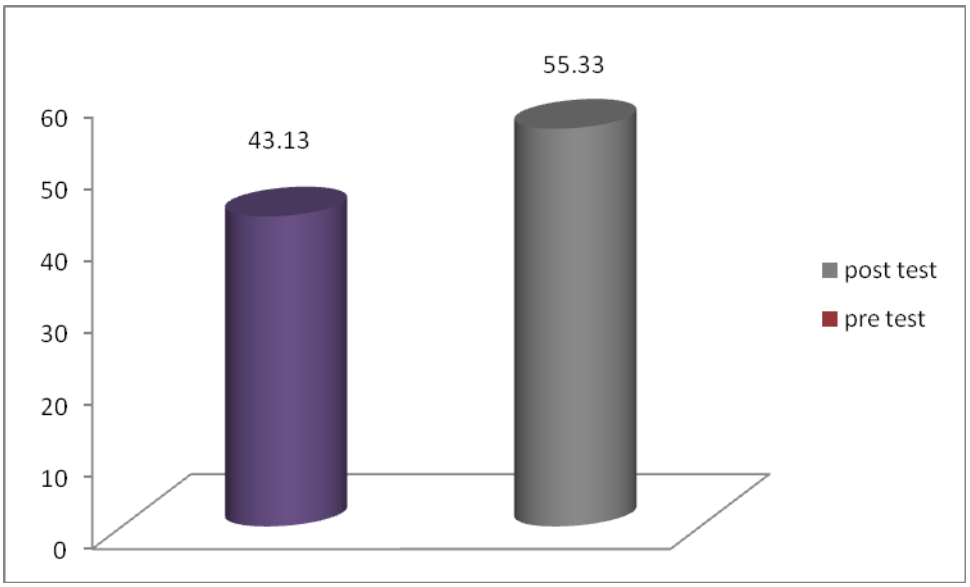


TABLE –V

Paired ‘t’ test

To compare the Pre test and Post test values of Group C – Wolf Motor Function Test

Within groups C	Mean	Mean difference	S.D	‘t’ value
Pre test	43.06	6.66	0.61	23.20
Post test	49.73			

The comparison of pre test and post test scores of group C showed that the ‘t’ value is 23.20 which is significantly greater than the critical ‘t’ value is 2.14 which implies the Statistically significant improvement in the group C after treatment.

GRAPH-III

Paired ‘t’ test

To compare the Pre test and Post test values of Group C – Wolf Motor Function Test

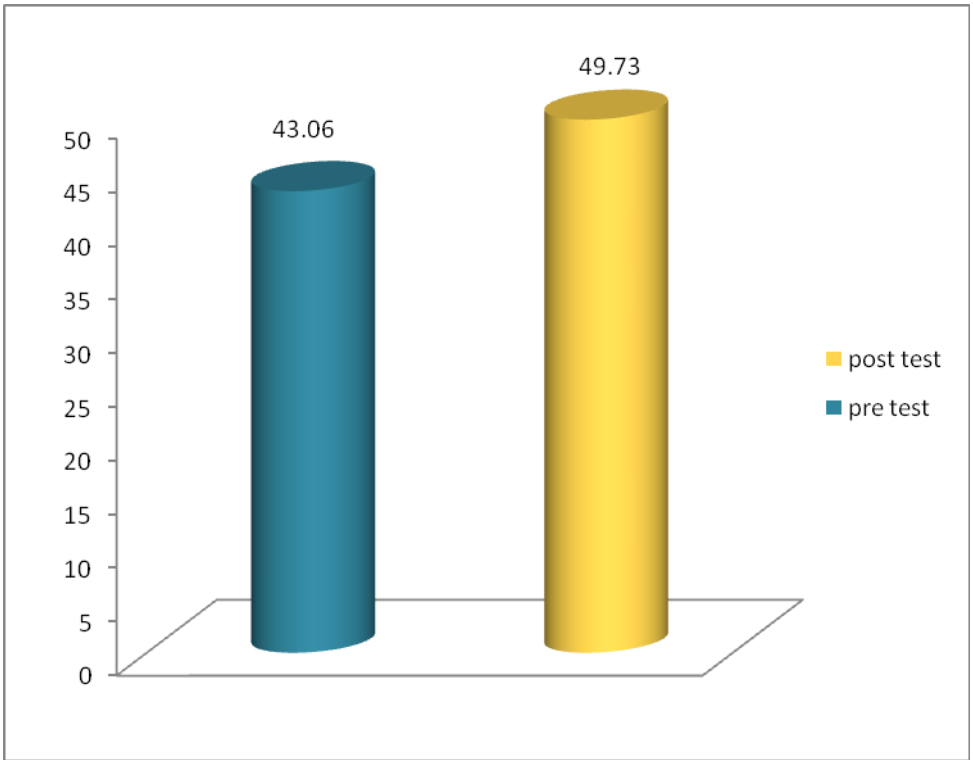


TABLE -VI

Unpaired‘t’ test

To compare the Pre-test scores of treatment Group A and Group B – Wolf Motor Function Test

Between groups	Mean	Mean difference	SD	‘ t’ value
Group A	42.86	0.26	6.5	0.28
Group B	43.13			

Comparison of Pre test values of Group A and B showed that the ‘t’ value is 0.28 which is significantly lesser than the critical ‘t’ value which is 2.04 which implies that there is an significant difference between the group A and B before treatment**.**

GRAPH-IV

Unpaired‘t’ test

To compare the Pre-test scores of treatment Group A and Group B – Wolf Motor Function Test

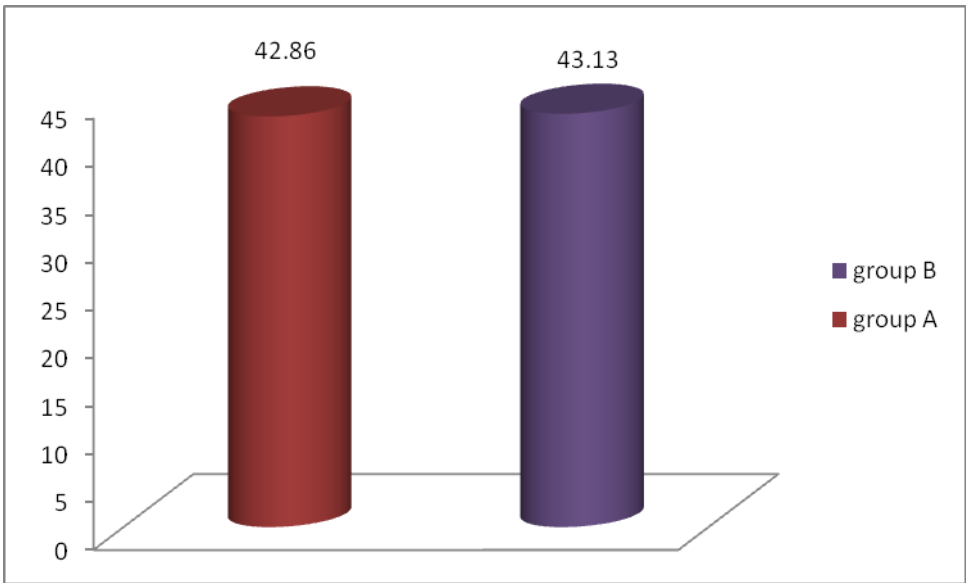


TABLE -VII

Unpaired 't' test

To compare the Pre-test scores of treatment Group A and Group C – Wolf Motor Function Test

Between groups	Mean	Mean difference	SD	't' value
Group A	42.86	0.2	6.55	0.22
Group C	43.06			

Comparison of pre test values of group A and C showed that the 't' value is 0.22 which is significantly lesser than the critical 't' value which is 2.04 which implies that there is an significant difference between the group A and C before treatment**.**

GRAPH-V

Unpaired‘t’ test

To compare the Pre-test scores of treatment Group A and Group C – Wolf Motor Function Test

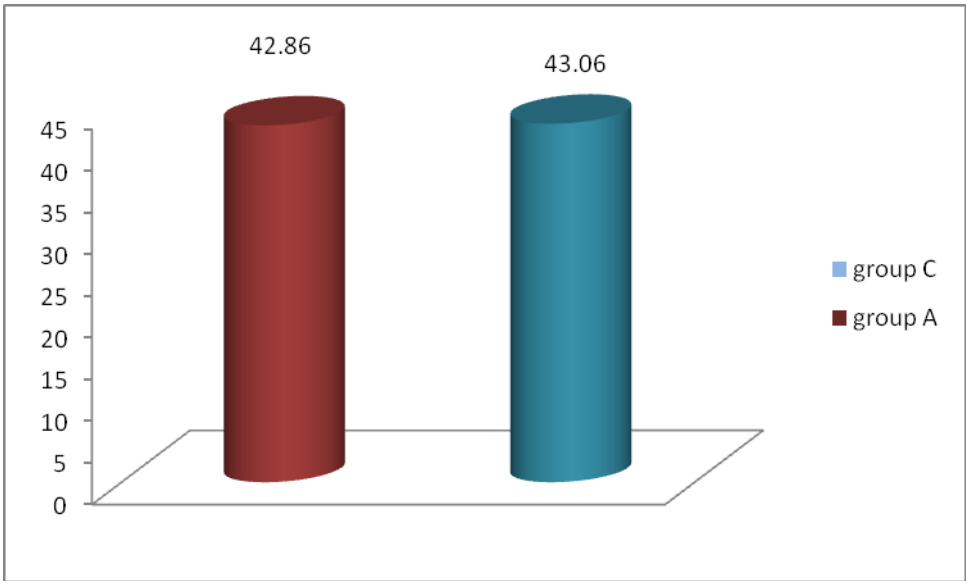


TABLE -VIII

Unpaired 't' test

To compare the Pre-test scores of treatment Group B and Group C – Wolf Motor Function Test

Between groups	Mean	Mean difference	SD	't' value
Group B	43.13	0.06	5.78	0.07
Group C	43.06			

Comparison of pre test values of group B and C showed that the 't' value is 0.07 which is significantly lesser than the critical 't' value which is 2.04 which implies that there is an significant difference between the group B and C before treatment**.**

GRAPH-VI

Unpaired‘t’ test

To compare the Pre-test scores of treatment Group B and Group C – Wolf Motor Function Test

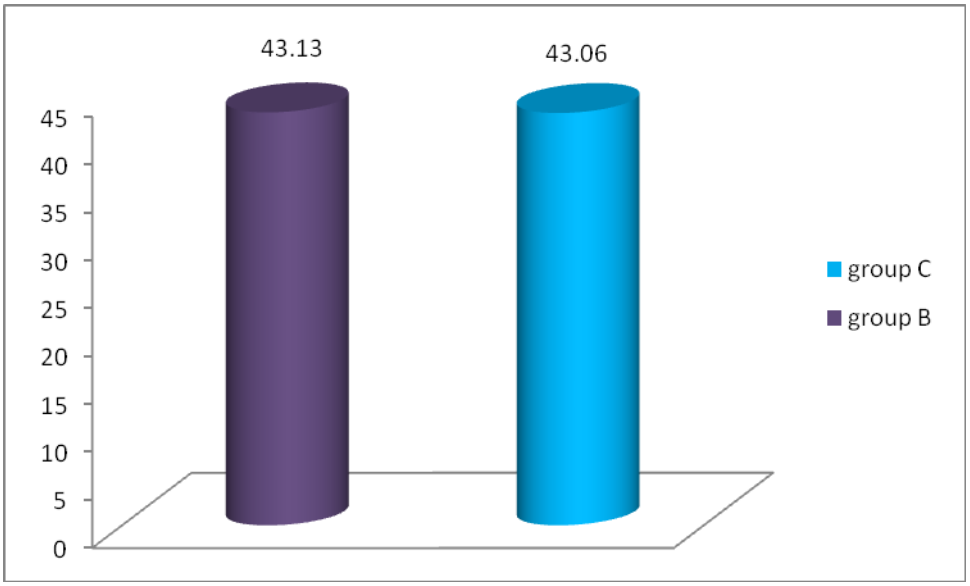


TABLE - IX

Unpaired ‘t’ test

To compare the Post - test scores of treatment Group A and Group B – Wolf Motor Function Test

Between groups	Mean	Mean Difference	SD	‘t’ value
Group A	63.53	8.2	2.76	6.09
Group B	55.33			

Comparison of post test values of group A and B showed that the‘t’ value is 6.09 which is significantly greater than the critical ‘t’ value which is 2.28 which implies that there is a significant difference between the group A and B after treatment**.**

GRAPH-VII

Unpaired‘t’ test

To compare the Post - test scores of treatment Group A and Group B – Wolf Motor Function Test

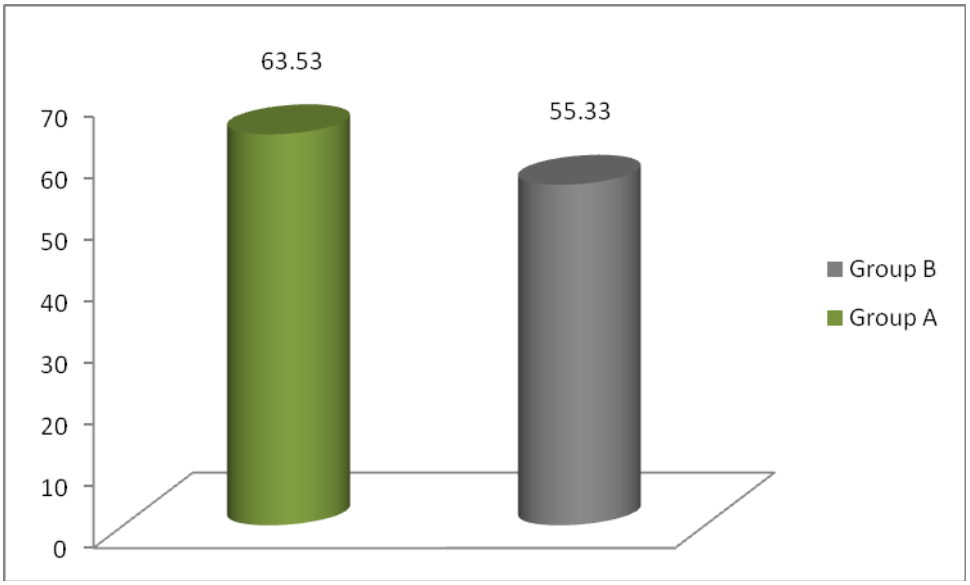


TABLE -X

Unpaired ‘t’ test

To Compare the Post Treatment Values of Group A and Group C

Between groups	Mean	Mean difference	SD	‘t’ value
Group A	63.53	13.8	2.87	9.84
Group C	49.73			

The comparison of Post treatment values of group A and C showed that the ‘t’ value is 9.84 which is significantly greater than the ‘t’ critical value is 2.28 after treatment.

GRAPH-VIII

Unpaired‘t’ test

To Compare the Post Treatment Values of Group A

And Group C- wolf motor function test

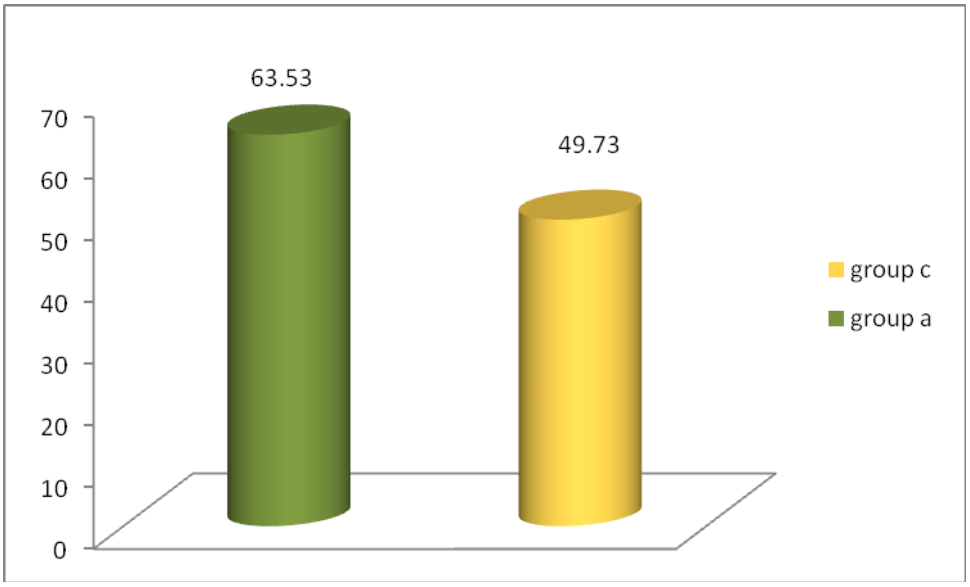


TABLE - XI

Unpaired ‘t’ test

To compare the Post test values of Group B and Group C

Between groups	Mean	Mean difference	SD	‘t’ value
Group B	55.33	5.6	2.183	5.26
Group C	49.73			

The comparison of post test treatment values of Group B and Group C showed that the ‘t’ value is 5.26 which is significantly greater than the critical ‘t’ value of 2.28 after treatment.

GRAPH-IX

To compare the Post test treatment values of group B and group C

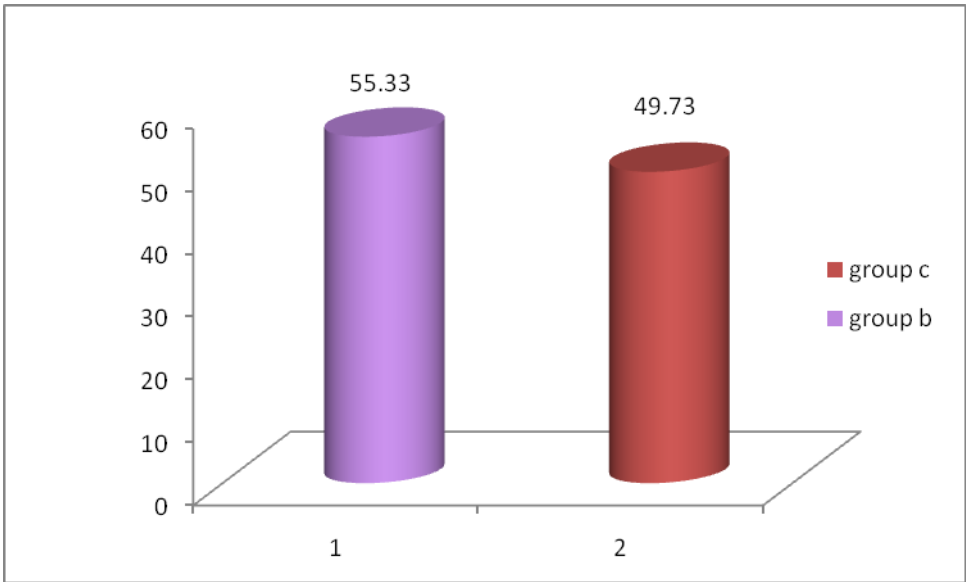


TABLE -XII

One way Anova to compare the pre-test scores of group A,B and C - Action Research Arm Test

Source of variations	Sum of squares	Degrees of freedom	Mean square	'F' value
Between groups	0.93	42	1.66	0.28 (F critical value) 3.21
Within groups	69.86	2	0.46	
Total	70.08	44		

The observed 'F'- ratio of 0.28 is lesser than the 'F'-critical value of 3.21 which indicates that there is no significant difference between the three groups before treatment.

TABLE -XIII

One way Anova to compare the post-test scores of group A,B and C - Action Research Arm Test

Source of variations	Sum of squares	Degrees of freedom	Mean square	'F'value
Between groups	997.51	2	498.75	157.73 (F critical value- 3.21)
Within groups	132.8	42	3.16	
Total	1130.31	44		

The observed 'F' ratio of is 157.73 greater than the 'F'critical value of 3.21 which indicates that there is a significant difference between the three groups after treatment.

TABLE -XIV

Paired ‘t’ test

To compare the Pre-test and Post-test values of group A – Action Research Arm Test

Within group A	Mean	Mean difference	SD	‘t’ value
Pre test	24.28	19.42	1.38	29.04
Post test	43.71			

Comparison of Pre-test and Post – test values of Group A showed that the ‘t’ value is 29.04 which is significantly greater than the critical ‘t’ value which is 2.16 this indicates there is a significant difference in Group A after treatment.

GRAPH-X

Paired ‘t’ test

To compare the Pre-test and Post-test values of Group A – Action Research Arm Test

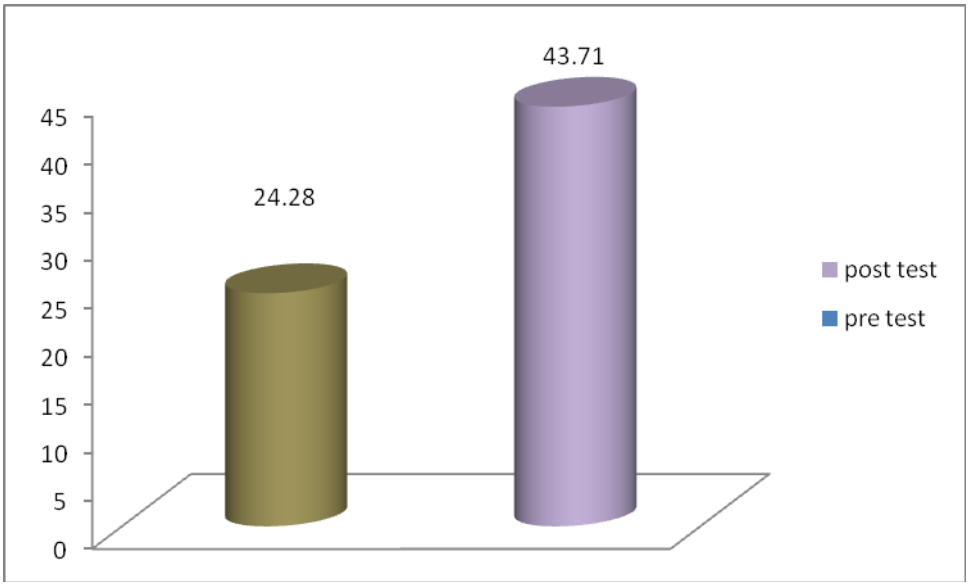


TABLE -XV

Paired ‘t’ test

To compare the Pre-test and Post-test values of Group B – Action Research Arm Test

Within group B	Mean	Mean difference	SD	‘t’ value
Pre test	24.21	15.07	1.23	26.04
Post test	39.28			

Comparison of Pre-test and Post – test values of Group B showed that the ‘t’ value is 26.04 which is significantly greater than the critical t value which is 2.16 this indicates that there is a significant difference in Group B after treatment.

GRAPH-XI

Paired ‘t’ test

To compare the Pre-test and Post-test values of Group B – Action Research Arm Test

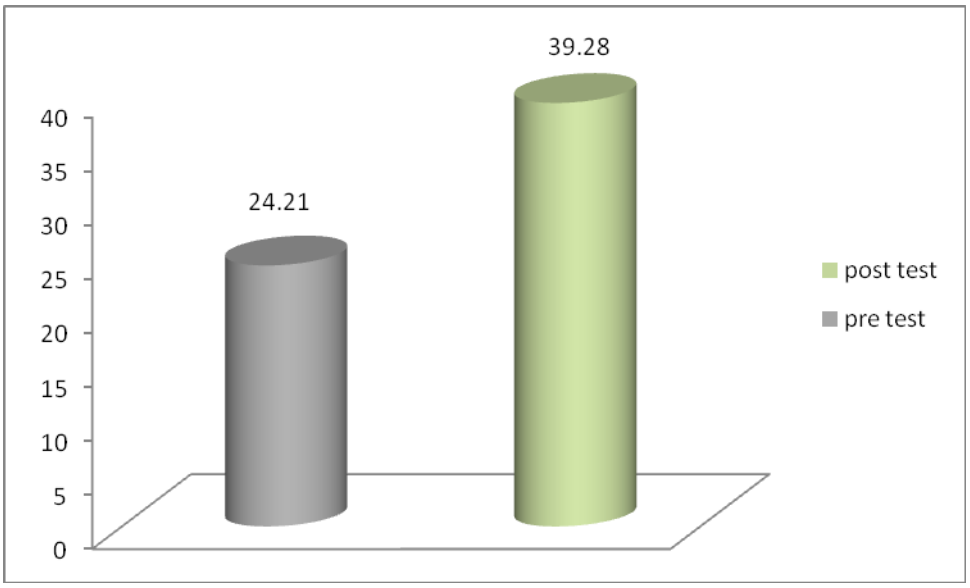


TABLE - XVI

Paired ‘t’ test

To compare the Pre-test and Post-test values of Group C – Action Research Arm Test

Within Group C	Mean	Mean difference	SD	‘t’ value
Pre test	23.92	8.57	1.08	16.79
Post test	32.05			

Comparison of Pre-test and Post-test values of Group C showed that the ‘t’ value is 16.79 which is significantly greater than the critical ‘t’ value which is 2.16 this indicates that there is a significant difference in Group C after treatment.

GRAPH-XII

Paired ‘t’ test

To compare the pre-test and post-test values of group C – Action Research Arm Test

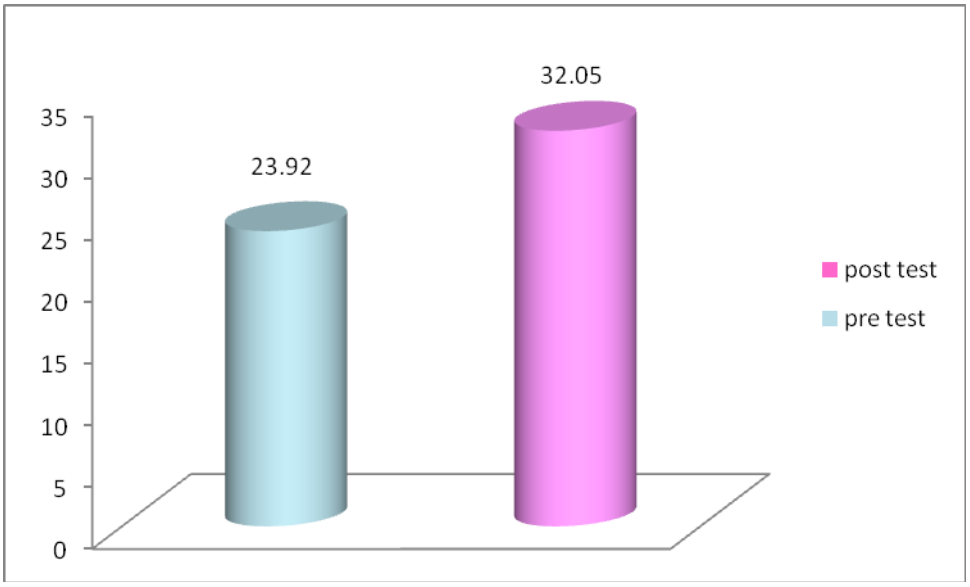


TABLE -XVII

Unpaired ‘t’ test

To compare the Pre treatment values of Group A and Group B – Action Research Arm Test

Between groups	Mean	Mean difference	SD	‘t’ value
Group A	24.13	0.06	0.92	0.14
Group B	24.02			

The comparison of Pre treatment values of group A and B showed that the‘t’ value is 0.14 which is significantly greater than the ‘t’ critical value is 2.14

GRAPH-XIII

Unpaired ‘t’ test

To compare the Pre treatment values of Group A and Group B

- Action Research Arm Test

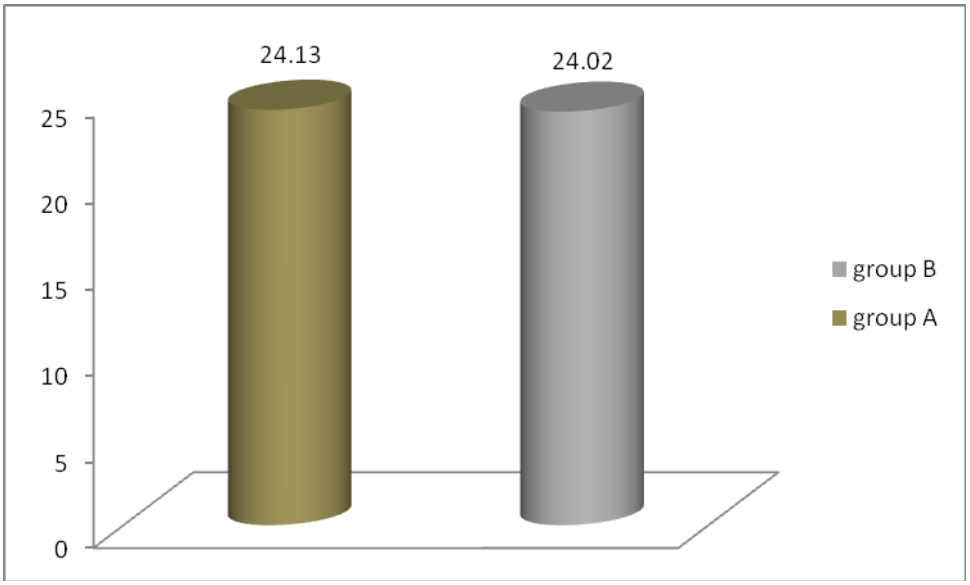


TABLE -XVIII

Unpaired ‘t’ test

To compare the Pre treatment values of Group A and Group C – Action Research Arm Test

Between groups	Mean	Mean difference	SD	‘t’ value
Group A	24.13	0.26	0.94	0.56
Group C	23.86			

The comparison of pre treatment values of group A and C showed that the‘t’ value is 0.56 which is significantly greater than the ‘t’ critical value is 2.14

GRAPH-XIV

To compare the Pre treatment values of Group A and Group C – Action Research Arm Test

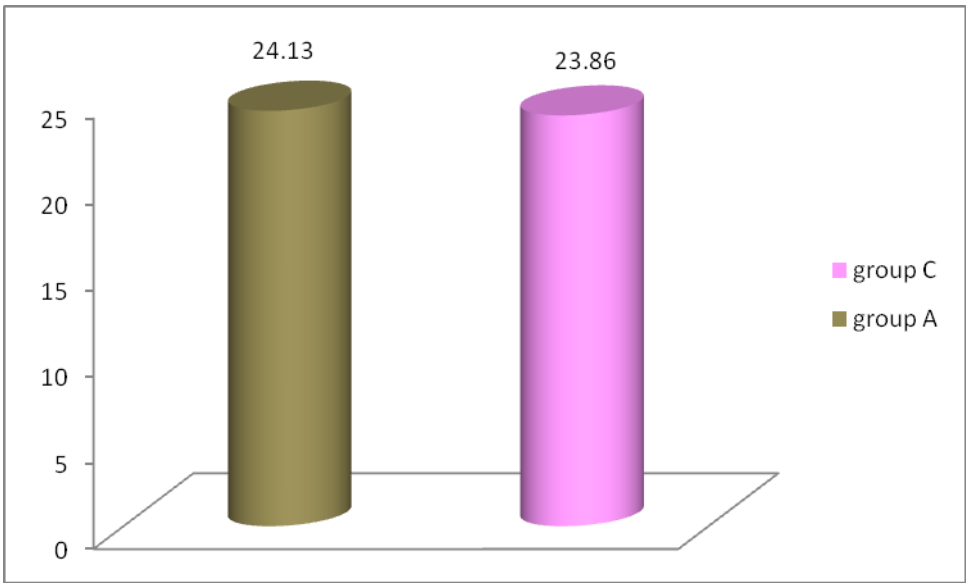


TABLE -XIX

Unpaired ‘t’ test

To compare the Pre treatment values of Group B and Group C – Action Research Arm Test

Between groups	Mean	Mean difference	SD	‘t’ value
Group B	24.02	0.33	0.92	0.71
Group C	23.86			

The comparison of pre treatment values of group B and C showed that the‘t’ value is 0.71 which is significantly greater than the ‘t’ critical value is 2.14

GRAPH-XV

Unpaired ‘t’ test

To compare the Pre treatment values of Group B and Group C

– Action Research Arm Test

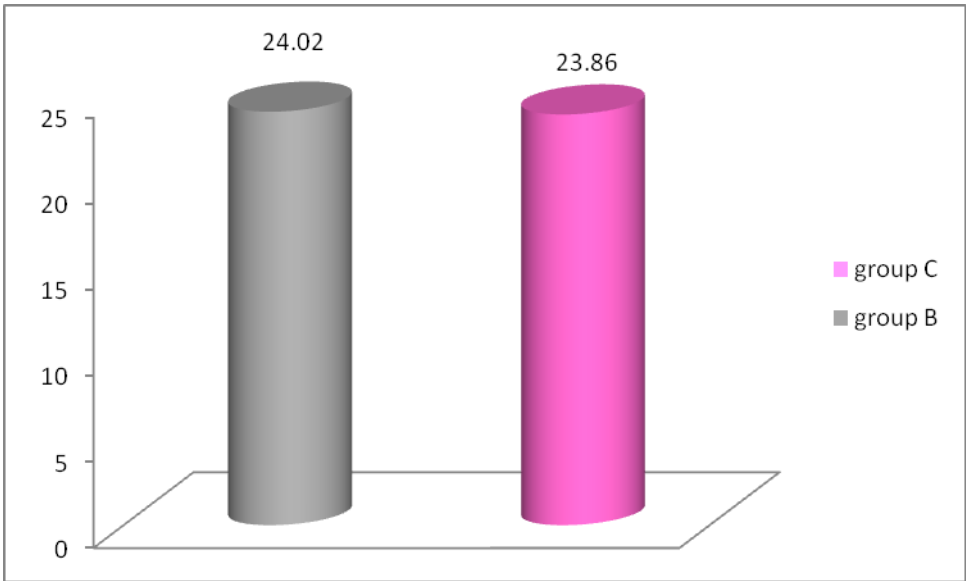


TABLE - XX

Unpaired ‘t’ test

To compare the Post treatment values of Group A and Group B – Action Research Arm Test

Between groups	Mean	Mean difference	SD	‘t’ value
Group A	43.73	4.66	1.32	7.21
Group B	39.06			

The comparison of post treatment values of group A and B showed that the‘t’ value is 7.21 which is significantly greater than the ‘t’ critical value is 2.04 this shows that there is a significant difference between Group A and B after treatment.

GRAPH-XVI

To compare the Post treatment values of Group A and Group B – Action Research Arm Test

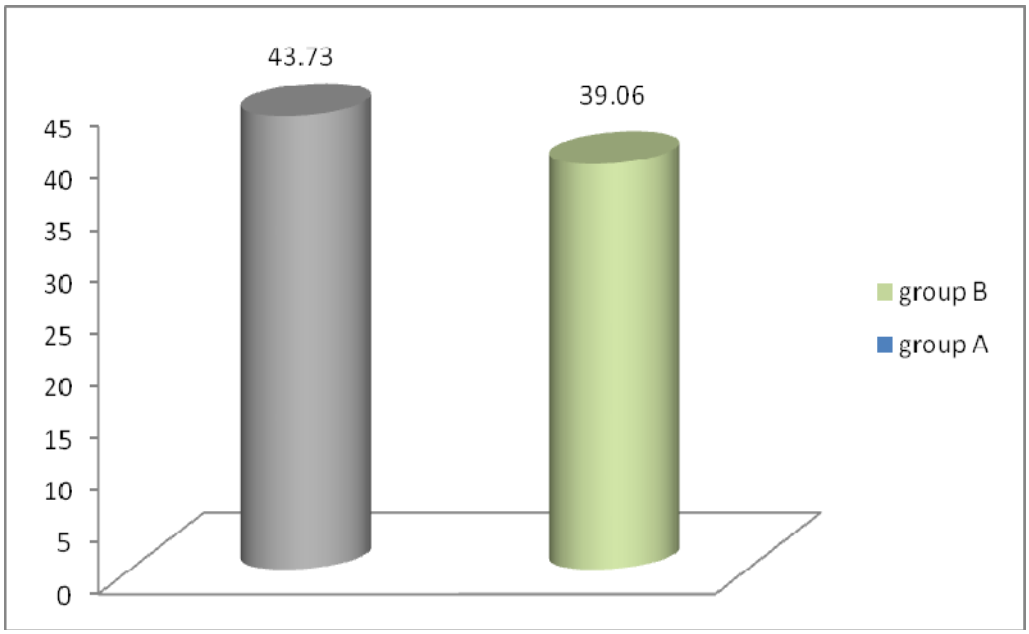


TABLE -XXI

Unpaired ‘t’ test

To compare the Post treatment values of Group A and Group C – Action Research Arm Test

Between groups	Mean	Mean difference	SD	‘t’ value
Group A	43.73	11.46	1.33	16.97
Group C	32.26			

The comparison of post treatment values of group A and C showed that the‘t’ value is 16.97 which is significantly greater than the ‘t’ critical value is 2.04 this shows that there is a significant difference between Group A and C after treatment.

GRAPH-XVII

To compare the Post treatment values of Group A and Group C – Action Research Arm Test

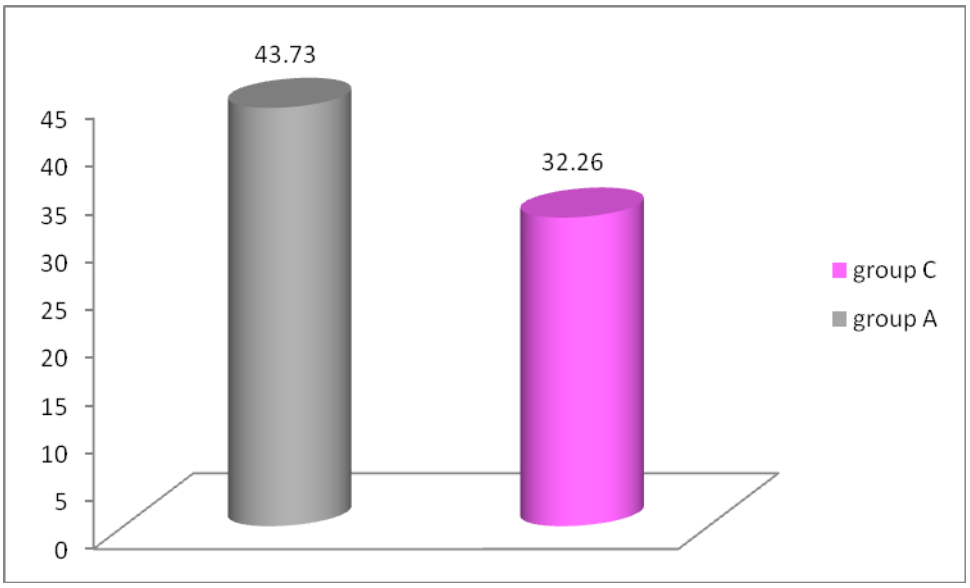


TABLE – XXII

Unpaired ‘t’ test

To compare the Post treatment values of Group B and Group C – Action Research Arm Test

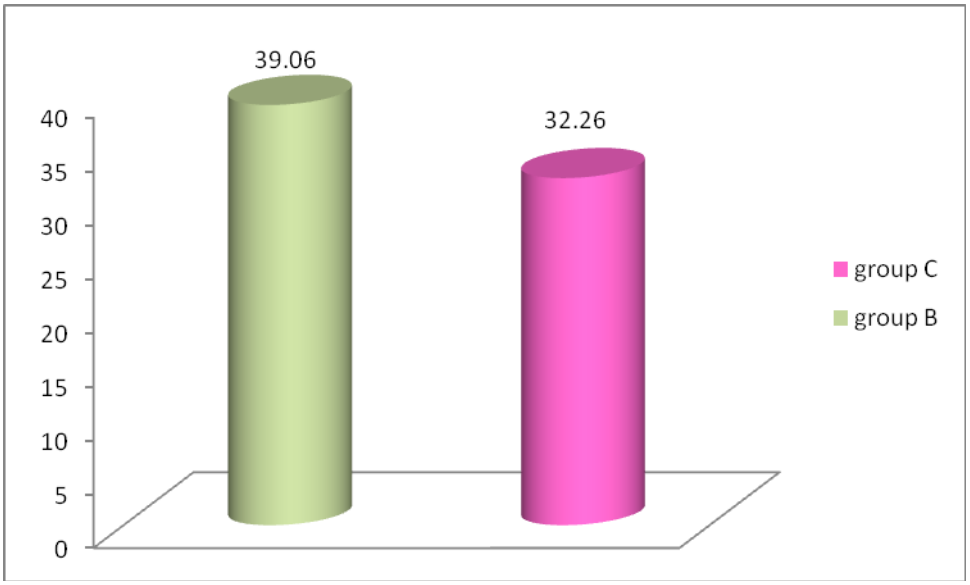
Between groups	Mean	Mean difference	SD	‘t’ value
Group B	39.06	6.8	1.28	10.89
Group C	32.26			

The comparison of post treatment values of group B and C showed that the‘t’ value is 10.89 which is significantly greater than the ‘t’ critical value is 2.04 this shows that there is a significant difference between Group B and C after treatment.

GRAPH-XVIII

Unpaired ‘t’ test

To compare the Post treatment values of Group B and Group C – Action Research Arm Test



V. DISCUSSION

Stroke is a multifaceted disorder with complexity ranging from very simple to extremely complex manifestations. The lack of detailed information about the neuro pathology of the various stroke syndromes has lead to the dearth of knowledge about the recovery of function, which has contributed to confusion about the therapeutic approaches used for facilitating functional recovery after stroke. Although stroke involves both upper limb and lower limb the most common manifestation seems to be a more severe involvement of the upper extremity than the lower extremity. The possible reasons could be that the territory which is more involved in stroke is the middle cerebral artery which predominantly supplies the arm and the hand. Another possible reason could be that the brain has extensive innervations for the hand than the foot and rest of the lower limb. Minor deficit in the arm and hand could cause more extensive morbidity. As recovery is delayed due to these reasons, the rehabilitation of the stroke involves a variety of approaches developed by several individuals which focus on several intervened mechanisms. The dearth of knowledge about the mechanism of recovery has lead to development of approaches adapting a particular mechanism while neglecting the others and in turn such an approach will lead to conflicting results. Modified Proprioceptive neuromuscular facilitation with novel repetitive facilitation approach is a

new and modified method of Proprioceptive neuromuscular facilitation technique which tries to adapt newer mechanisms into an existing mechanism there by enhancing the effects.

The purpose of the study was to analyze the effects of modified Proprioceptive neuromuscular facilitation using repeated neuromuscular facilitation in the improvement of upper extremity function in patients with sub acute hemiparesis.

45 subjects were taken based on selection criteria and randomly divided into 3 groups of 15 each. Group A patients were treated with modified Proprioceptive neuromuscular repeated facilitation for about 30 minutes and repeated neuromuscular facilitation 30 minutes. Group B were treated with Rood's approach 10 – 15 minutes combined with conventional therapy 45 minutes. Group C were treated with conventional therapy alone for about 60 minutes.

The patients were given 6 weeks of therapy with periodic follow up. The three groups were analyzed using one – way analysis of variance whether there was any difference between them. The post-hoc test was done to analyze the difference between individual groups. The results were analyzed and outcome was tabulated. From analysis of data using the one way Anova can be seen that there was no significant difference between three groups in

the Wolf Motor Function Test and Action Research Arm Function Test before treatment this can be demonstrated by the insignificant 'F' ratio of 0.045 for the Wolf Motor Function Test and 0.28 for Action research arm test which are significantly lesser than the 'F' critical value 3.21 and the 'P' value 0.95 was greater than 0.05 this signifies that there is no significant difference between three groups before treatment. After treatment there was significant difference between the three groups which can be reflected in significantly high 'F' ratio in both Wolf Motor Function Test and Action Research Arm Function Test.

The 'F' value for Wolf Motor Function Test is 58.81 and the 'P' value is 0.0065 which demonstrates that there is a significant difference between three groups after treatment. Similarly in Action Research Arm Function Test the 'F' value is 157.73 and the 'P' value is 0.0029 which reflects that there is some significant difference between the three groups. In order to analyze the treatment effects of three groups, an initial paired 't' test was done to analyze whether there was a significant difference before and after treatment in all the three groups with Wolf Motor Function Test and Action Research Arm Function Test. The Wolf Motor Function Test and the Action Research Arm Function Test both revealed that there was a significant improvement in all the three groups. When comparing the pre treatment and

post treatment scores there was a significant improvement in all the three groups after treatment. Now unpaired ‘t’ test was done by comparing all the three groups in order to identify which Group had more significant improvement by initially comparing with Group A and Group B, Group B and Group C and finally with Group A and C this analysis was done using both pre and post treatment scores.

The pre treatment scores revealed no significant difference when comparing with all the three groups. However when comparing the post treatment values with Group A with Group B and Group C there was a significant improvement in Group A patients. This is reflected by the highly significant ‘t’ score in both Wolf motor function test and Action research arm function test.

When comparing Group B and Group C there was also significant improvement between group B and group C. allowing us to conclude that group A and group B. Patients receiving Modified Proprioceptive Neuromuscular Repeated Facilitation and Rood’s approach showed better results than patients treated with conventional physiotherapy. Comparison of (Group A) treated with Modified Proprioceptive Neuromuscular Repeated Facilitation and Rood’s Approach the (Group B) patients treated with Rood’s approach showed that there was more significant improvement in

Group A than in Group B allowing us to conclude that the Modified Proprioceptive Neuromuscular Repeated Facilitation results in better outcome after sub acute stroke.

The possible reasons for improvements could be that normal facilitation methods give adequate physical stimulation to realize the patient's intended movements. These stimulations were given simultaneously to induce the target movements when synchronized as through temporal combinations and postures of the stretched muscles.

These methods allowed direct elicitation of isolated movements of each finger wrist and shoulder and combined movements of the shoulder, elbow, wrist and fingers which were similar to the Proprioceptive Neuromuscular Facilitation Technique but differed from it in the proximal stimulations used to elicit movements.

These methods also attached greater importance to proximal movements than to distal movements and shoulder flexion – adduction than to shoulder extension – abduction. In particular these facilitation methods could be repeated so smoothly that it was possible to perform as many as 500- 800 repetitions ;that is 100 repetitions of each of (5-8) patterns within 30 minutes (**Woldag** et al 2003) repetitive training of complex hand and arm movements resulted in greater improvements in the motor function of the

hemiplegic upper limb than the conventional neuromuscular facilitation techniques another reason could be that repetition of identical movements exclusively for motor learning (**Keller** et al 1991).

Other reasons could be that practice of voluntary movement isolated from synergy with repetition could isolate the synergy from the hemiplegic limb **(Schimodozono** 2004).

Over all there was a significant improvement in all the Groups using Facilitation techniques and Conventional physiotherapy than when treated with Conventional physiotherapy alone. Among Facilitation Techniques Modified Proprioceptive Neuromuscular Facilitation with Repeated Facilitation yield better results.

VI. CONCLUSION

The recovery of function after brain injury is largely due to neural plasticity but the extent of recovery varies depending on a large number of factors such as type of stroke, territory involved, duration of symptoms, promptness of treatment etc. The conflicting nature of the vascular accidents has made it extremely difficult to predict functional recovery especially for the upper limb.

Repetitive facilitation exercises focuses on isolation of synergy and forceful elicitation of the targeted movement which has been set to facilitate good motor recovery. From the analysis of data it can be conclusively demonstrated that there is significant improvement in the functional motor outcome of the hemiplegic upper extremity when using a Modified Neuromuscular Facilitation with Repeated Facilitation can be used on the routine basis for treatment of stroke patients with upper extremity dysfunction.

VII. LIMITATIONS AND RECOMMENDATIONS

- Study is of short duration the longer duration of the study is needed to conclusively validate the results.
- A stratification of the samples based on various age groups would demonstrate better understanding of recovery on different age groups.
- Sample bias cannot be avoided in all situations.
- The effect of extraneous factors such as temperature, humidity, pressure etc cannot be controlled strictly.
- A larger sample may be used to better to remove the possibility of the error in the data.
- The study does not isolate the effect of Modified Proprioceptive Neuromuscular Facilitation with Repeated Neuromuscular Facilitation at present there is no comparing the differences in the treatment effects between the Modified Proprioceptive Neuromuscular Facilitation with Repeated Neuromuscular Facilitation and the conventional Proprioceptive Neuro Muscular Facilitation approaches.
- The study can be done further by comparing Modified Proprioceptive Neuromuscular Facilitation with Repeated facilitation against other treatment approaches such as Brunnstrom, Bobath, Functional approaches etc.

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APPENDIX-I

PATIENT'S PROFILE

Name:

Age:

Sex:

Occupation:

Date of admission:

Date of assessment:

Chief complaints:

Past medical history:

Present medical history:

Personnel history:

Family history:

Associated problems:

Vital signs:

Temperature:

Pulse:

Respiratory rate:

Blood pressure:

ON OBSERVATION:

Body built:

Posture:

External appliances:

Deformities:

Skin changes:

ON EXAMINATION:

Higher functions:

Level of consciousness:

Orientation:

Memory:

Vision:

Speech:

Hearing:

Cranial nerve examination:

Sensory examination:

Superficial sensation:

Deep sensation:

Cortical sensation:

Motor Assessment:

Tone:

Reflexes:

Superficial reflex:

Deep reflex:

Voluntary control of movement:

Range of motion:

Co- ordination:

Balance reactions:

Hand function:

Activities of daily living:

Diagnosis:

Problem list:

Aims:

Means:

APPENDIX-II

Action Research Arm Function Test

Instructions

There are four subtests.

- If the subject passes the first test, no need to administer and he scores top marks for that subtest.
- If the subject fails the first and second, he scores zero and again no test need to be performed.
- Otherwise he needs to complete all tasks within the subtest.

Patient Name: ----------

Age: ----------

Date: ----------

	ACTIVITY	SCORE			
S.no		0	1	2	3
	GRASP				
1	Block, wood, 10 cm cube Pick up a 10 cm block				
2	Block, wood, 2.5 cm cube Pick up a 2.5 cm block				
3	Block, wood, 5 cm cube				
4	Block, wood, 7.5 cm cube				
5	Ball(cricket), 7.5 cm diameter				
6	Stone 10x2.5x1 cm				
	Total	18			
	GRIP				
1	Pour water from glass to glass				
2	Tube 2.25				
3	Tube 1x16 cm				
4	Washer (3.5 cm diameter) over belt				
	Total	12			
	PINCH				
1	Ball bearing 6mm, 3rd finger and				
2	thumb				
3	Marble, 1.5 cm index finger and thumb				
4	Ball bearing 2nd finger and thumb				
5	Ball Bearing 1st Finger And Thumb				
6	Marble 3rd finger and thumb Marble 2nd finger and thumb				
	Total	18			
	GROSS MOVEMENT				
1	Place hand behind the head				
2	Place hand on top of head				
3	Hand to mouth				
	Total	9			
	Overall total	57			

APPENDIX- III

WOLF MOTOR FUNCTION TEST

The tasks listed below are performed as quickly as possible while being timed maximum for each task is 120 seconds.

Tasks are as follows:

1. Forearm to table (side): subject's attempts to place forearm on the table by abduction at the shoulder.

2. Forearm to box (side): Subject's attempts to place a forearm on the box by abduction at the shoulder.

3. Extend elbow (side): Subject attempts to reach across the table by extending the elbow (to the side).

4. Extend elbow (to the side), with weight: subject's attempts to push the sand bag against outer wrist joint across the table by extending the elbow.

5. Hand to table (front): Subject's attempts to place involved hand on the table.

6. Hand to box (front): Subject's attempts to place hand on the box.

7. Reach and retrieve (front): subjects attempts to pull 1- lb weight across the table by using elbow flexion and cupped wrist.

8. Lift can (front): Subject's attempts to lift can and bring it close to lips with a cylindrical grasp.

9. Lift pencil (front): subject's attempts to pick up pencil by using 3-jaw check grasp.

10. Pick up paper clip (front): subject's attempts to pick up paper clip by using a pincer grasp.

11. Stack checkers (front): subject's attempts to stack checkers on the centre checker.

12. Flip cards (front): using the pincer grasp, patient attempts to flip each card over.

13. Turning the key in lock (front): using the pincer grasp, while maintaining contact, patients turn key fully to the left and right.

14. Fold the towel (front): subject's grasp towel, fold it length wise and then uses the tested hand to fold the towel in half again.

15. Lift basket (standing): Subject picks up basket by grasping the handle and placing it on bedside table.

Total score : 15

Able to perform : 1

Unable to perform : 0

APPENDIX-IV

Brunnstorm's Motor Recovery Stages:

Stage 1: initial flaccidity – no voluntary control of movement.

Stage 2: emergence of spasticity; hyper reflexia, synergies (mass pattern of movement).

Stage 3: voluntary movements are possible but only in synergies spasticity strong.

Stage 4: voluntary control in isolated joint movements emerging, corresponding decline of spasticity and synergies.

Stage 5: increase voluntary control out of synergy; co- ordination deficits are present.

Stage 6: control and co ordination near normal.

APPENDIX-V

CONVENTIONAL PHYSIOTHERAPY

UPPER EXTREMITIES

IN LYING

1. Self Assisted Arm Movements
2. Small circles in the air with the elbow extended
3. Touching the head and up again
4. Touching the opposite shoulder and lift it again
5. Flexion and extension of the elbow with the hand in dorsiflexion
6. Holding a pole in both the hands, lowering and rising it

IN SITTING:

1. Protective extension sideways-hands outstretched
2. Holding a towel in the affected hand and makes circle
3. Holding rolled towel, vertically walk hand upward
4. Place hand flat against the therapist hand and move without resistance
5. Weight transference through the arms behind and sideways

IN STANDING:

1. Weight bearing through the extended arms
2. Weight bearing on the affected arm while rotating the trunk away
3. Hands flat on the wall and lift sound leg

OTHER ACTIVITIES:

1. Reaching forward
2. Grasping and releasing objects
3. Step up and step down
4. Heels raise and lower.

APPENDIX – VI

ROOD'S APPROACH

Facilitatory or inhibitory inputs are achieved through the use of sensory motor stimuli, including fast brushing, light touch, stroking, icing, stretching, tapping, and applying pressure and resistance to promote contraction of proximal muscles. One common example is light brushing of the lips to facilitate both flexion of the hemiplegic arm and a hand-to-mouth pattern of movement .The aim of this approach is the modification of muscle tone and voluntary motor activity using cutaneous Sensorimotor stimulation.

CUTANEOUS STIMULATION USING QUICK LIGHT BRUSHING:

- This is used to increase the excitability of motor neurons which supply inhibited muscles.
- The area to be brushed is specific in terms of the nerve root supply to skin and the muscle.
- A changing stimulus is needed and is continued only for a short time in one place.

ICING:

Quick wipe 5-8 strokes with an ice cube this also has an excitatory effect which is immediate and most effective when applied to the skin overlying the extensors of limbs. Ice applied to the lips/ tongue facilitates sucking, swallowing and speech.

SLOW STROKING:

This is carried out from neck to sacrum over the centre of the back it will reduce excessive muscle tone. It should be applied rhythmically for 3 minutes.

APPENDIX – VII

Modified Proprioceptive Neuro Muscular Facilitation

1. Shoulder flexion with 90º elbow flexion in the supine position. To facilitate the shoulder flexion the therapist taps over the anterior part of the deltoid muscle with his fingers
2. Shoulder horizontal extension/ flexion with elbow flexion in the supine position. To facilitate shoulder horizontal extension/flexion, rapid stretching and rubbing of the deltoid muscle were applied by the therapist.
3. Shoulder flexion, adduction, external rotation with flexion of the elbow and forearm supination. To facilitate the movements, tapping, rubbing and rapid stretching of the muscles were applied by the therapist.
4. Shoulder flexion/ abduction /external rotation with elbow extension accompanied by wrist dorsiflexion and finger extension.The therapist tapped and rubbed the inside of the deltoid muscle using his fingers to elicit shoulder flexion, while his thumb provided resistance

5. Forearm supination/pronation with elbow 90 flexion in the sitting position. To facilitate the movements, tapping, rubbing and rapid stretching of the muscles were applied by the therapist.
6. Wrist dorsiflexion and forearm pronation with extension of the fingers in the supine position. To facilitate forearm pronation and wrist dorsiflexion with finger extension, the therapist held the abductor pollicis brevis, quickly pull the fingers, quickly supinate the forearm and tapped the ulnar side of the dorsal hand using his thumb.
7. Finger extension with wrist flexion in the supine position. To facilitate isolated volar abduction of the thumb, tapping, rubbing and rapid stretching of the muscles were applied by the therapist.
8. Finger extension/flexion with wrist flexion in the sitting position. To facilitate isolated finger extension/ flexion, tapping, rubbing, rapid stretching of the muscles and slight resistance against finger movements were applied by the therapist.

APPENDIX-VIII

CONSENT FORM

This is to certify that I …… freely and voluntarily agree to participate in the study **" A STUDY TO ANALYSE THE EFFECTIVENESS OF MODIFIED NEURO MUSCULAR REPEATED FACILITATION FOR THE UPPER EXTREMITY IMPROVEMENT IN SUB- ACUTE STROKE PATIENTS."**

I have been explained about the procedure and the risks that would occur during the study. Questions have been answered to my satisfaction.

Participation:

Witness:

Date:

I have explained and defined the procedure to which the subject has consented to participate.

Researcher:

Date: